

EXAMINER'S REMARKS

Claim 12 was objected to because of informalities.

Claims 1-3, 6-9, and 12-14 were rejected under 35 U.S.C. §112 as being indefinite.

Claims 1, 2, 4-6 and 8 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S.P.N. 5,623,355 to Olsen, hereinafter Olsen.

Claims 9-11, 13, 14 and 16-20 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S.P.N. 5,844,928 to Shastri et al, hereinafter Shastri.

Claims 7 and 12 were rejected under 35 U.S.C. §103(a) as being unpatentable.

Claims 3 and 15 would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims.

SUMMARY OF APPLICANTS' INVENTION

The present invention is an open-loop laser driver. The driver is commonly used to drive a VCSEL. VCSEL light output tends to degrade over the operating life of the laser, and is also dependent upon operating temperature. The present invention calculates optimum settings (including bias current, modulation current, negative peaking depth, and negative peaking duration) for the driver, for various possible temperatures and ages of the VCSEL. These settings are used by the driver to keep the light output steady over the life of the VCSEL, and over any temperature changes. The settings are stored in memory in a look-up table format for use during operation, using addresses based on the operating temperature and the age of the VCSEL.

REMARKS

Disclosure Informalities

Upon review of the disclosure, Applicants discovered on page 12, lines 18, 23, and 24, the Temperature Measurement Block (TMB) was incorrectly identified with reference number 234. As can be seen in Figure 3, the Temperature Measurement Block

is identified with reference number 334. The disclosure has been amended to correctly identify the Temperature Measurement Block with reference number 334. No new matter has been introduced with this amendment.

Claim Informalities

Claim 12 was objected to because of informalities. The office action asserted that claim 12 recited intended use of the laser driver. Applicants respectfully submit that claim 12 is not a recitation of intended use; rather, claim 12 is a further limitation upon claim 9.

Claim 9 recites “An open-loop laser driver for generating drive waveforms that drives an array having at least one semiconductor laser...” There are many types of semiconductor lasers: edge-emitting laser diodes, vertical cavity surface emitting lasers (VCSEL), etc. In claim 12, the semiconductor laser is further limited to a VCSEL.

Since claim 12 further limits claim 9, claim 12 is believed to be allowable. No new matter has been introduced with this amendment. The objection to claim 12 is believed to be overcome.

Claim rejections - 35 U.S.C. §112

Claims 1-3, 6-9, and 12-14 were rejected under 35 U.S.C. §112 as being indefinite. In claims 1, 2 and 3, there was found to be insufficient structure for the driver circuit to perform the claimed function. In claim 9, there was found to be insufficient structure for the digital controller to perform the claimed function.

Claim 1 lacked supporting structure for the driver circuit to perform the claimed function. There was no relationship evident between the driver circuit and the age/temperature compensation mechanisms. The age compensation mechanism and a temperature compensation mechanism have been included in the structure for the driver circuit. Support for this amendment can be found on page 6, lines 8-16. Claim 1 is believed to be allowable.

Claim 2 has also been amended to recite that each semiconductor laser in an array has its own set of drive waveform parameters, wherein the parameters include both ac

and dc properties. Support for this amendment can be found on page 6, lines 17-23 and page 2, lines 17-21. Claim 2 is believed to be allowable.

Claim 3 was rejected also because of insufficient structure. There was no relationship evident between the ac/dc properties and the semiconductor lasers. The amendments to claims 1 and 2 (upon which claim 3 is dependent) are believed to be sufficient to give claim 3 enough structure. Claim 3 is believed to be allowable. Claim 6-8 are believed to be allowable based on the allowability of claim 1.

Claim 9 was rejected because there was insufficient structure for the digital controller to perform the claimed function. Claim 9 has been amended to specify that each drive waveform is associated with its own set of drive waveform parameters. Support for this amendment can be found on page 6, lines 17-23. Claim 9 is believed to be allowable. Claims 12-14 are believed to be allowable based on the allowability of claim 9.

No new matter has been introduced with these amendments. The rejections to claims 1-3, 6-9, and 12-14 are believed to be overcome.

Claim rejections - 35 U.S.C. §102: Claims 1, 2, 4-6 and 8

Claims 1, 2, 4-6 and 8 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S.P.N. 5,623,355 to Olsen, hereinafter Olsen.

Olsen teaches a closed-loop laser data transfer system that includes a laser transmitter 10 for producing a light output. The light output is monitored for changes and errors by a photosensitive diode 38 (see Figure 2). Information about any errors in the light output is transmitted back to the transmitting processor 18 in a feedback loop, in the form of an error signal 20 (see Figure 2). Olsen mentions some factors that cause laser light output to change, including aging and temperature fluctuations (column 3, lines 33-40), but does not compensate based on those factors. Rather, the transmitting processor 18 of the laser transmitter 10 compensates for changes in the laser light output based on the error signal 20 (column 3, lines 18-20).

In distinct contrast to Olsen, the present invention is an open-loop laser driver that does not require feedback about the light output in order to compensate for changes. In fact, the present invention teaches that closed-loop systems involving feedback or

photodiodes (such as the system taught by Olsen) are costly and needlessly complex
 → (page 3, lines 17-22). Instead, the present invention relies on predetermined driver settings (stored in memory) that were optimized for various temperatures and ages of the VCSEL (Page 17, lines 15-19). By determining the current age and temperature of the
 → VCSEL, the driver can preemptively compensate for variations in the light output by simply using the settings that have been optimized for the current conditions. An age compensation mechanism 240 and a temperature compensation mechanism 260 help determine which driver settings to use.

This unique feature can now be found in claim 1: "An optical transmitter comprising...a driver circuit, coupled to the memory and the array, having an age compensation mechanism and a temperature compensation mechanism...." Claim 1 is believed to be patentable. Dependent claims 2, 4-6, and 8 are believed to be allowable based on the allowability of claim 1. No new matter has been introduced with this amendment. The rejections to claims 1, 2, 4-6 and 8 are believed to be overcome.

Claim rejections - 35 U.S.C. §102: Claims 9-11, 13, 14 and 16-20

Claims 9-11, 13, 14 and 16-20 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S.P.N. 5,844,928 to Shastri et al, hereinafter Shastri.

Shastri teaches a closed-loop laser driver 10. The light output is monitored for changes and errors by a photosensitive diode 16. Information about any changes and errors is transmitted back in a feedback loop 34 to the control portion 36 of an integrated circuit 18. (See Figure 2)

In distinct contrast to prior art, the present invention is an open-loop laser driver that does not require feedback about the light output in order to compensate for changes. In fact, the present invention teaches that closed-loop systems involving feedback or photodiodes (such as the system taught by Shastri) are costly and needlessly complex (page 3, lines 17-22). Instead, the present invention is an open-loop driver that relies on predetermined driver settings (stored in memory) optimized for various temperatures and ages of the VCSEL (Page 17, lines 15-19). By determining the current age and temperature of the VCSEL, the driver can preemptively compensate for variations in the

light output by simply using the settings that have been optimized for the current conditions.

This unique feature can now be found in claim 9: "An open-loop laser driver..." (emphasis added) and in claim 16: "A method for providing a drive waveform for at least one semiconductor laser in an open-loop laser driver (emphasis added).

Claims 9 and 16 are believed to be allowable based on the patentable features recited within. Claims 10, 11, 13, and 14 are believed to be allowable based on the allowability of claim 9. Claims 17-20 are believed to be allowable based on the allowability of claim 16. No new matter has been introduced with this amendment. The rejections to claims 9-11, 13, 14 and 16-20 are believed to be overcome.

Claim rejections - 35 U.S.C. §103

Claims 7 and 12 were rejected under 35 U.S.C. §103(a) as being unpatentable, since using a driver circuit to drive a VCSEL is notoriously well known in the art.

In the above section entitled "***Claim rejections - 35 U.S.C. §102: Claims 1, 2, 4-6 and 8,***" the optical transmitter of claim 1 was shown to be unique and patentable. As recited in claim 1, the optical transmitter has: "an array having at least one semiconductor laser." There are many types of semiconductor lasers, as explained earlier in the section "***Claim Informalities***". Dependent claim 7 further clarifies and narrows claim 1 to specify that the laser is a VCSEL. Since the optical transmitter of claim 1 is unique and patentable, then the unique optical transmitter having a VCSEL (as claimed in dependent claim 7) should also be unique and patentable.

Similarly, in the above section entitled "***Claim rejections - 35 U.S.C. §102: Claims 9-11, 13, 14 and 16-20***" the laser driver of claim 9 was shown to be unique and patentable. As recited in claim 9, the laser driver "drives an array having at least one semiconductor laser." Since there are many types of lasers, dependent claim 12 further clarifies and narrows claim 9 to specify that the laser driver drives a VCSEL. Since the laser driver of claim 9 is unique and patentable, then the unique laser driver driving a VCSEL (as claimed in dependent claim 12) should also be unique and patentable.

No new matter has been introduced with this amendment. The rejections to claims 7 & 12 are believed to be overcome.

CONCLUSION

If the Examiner has any further questions or would like to discuss this application in more detail, he is invited to call the Applicants' agent at the telephone number given below. The Applicants respectfully suggest that the claims presently in the application are distinct over the prior art and that the application is now in condition for allowance. Accordingly, the Applicants solicit favorable action.

Respectfully submitted,
Jesse Chin, et al.

A handwritten signature in black ink, appearing to read "Judy L. Shie", written over a horizontal line.

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